The Madras Agricultural Journal

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TO OUR CONTRIBUTORS.

Paper is still in short supply. The cost of printing is high — and the Editorial Board will feel obliged if your articles are brief.

The Madras Agricultural Journal

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Vol. XXXVI July 1949 No. 7

Editorial

The Food Front: Within a period of two years India is to become entirely self-sufficient with regard to her food requirements and all food imports from abroad should cease by 1951. This is the objective set forth by the Prime Minister of India and he has appealed to the Nation to make serious efforts in this direction. While the problem of maintaining our food production to the level of our needs in relation to the rapidly growing population of the country is a large range problem and should be tackled as such, the immediate problem is what should be done here and now to make good the deficit of our basic requirements within the stipulated period of two years. A special organisation has been set up and a Commissioner of food production has been appointed to tackle the problem on an All-India basis. The highest priority is to be given to the food problem both in the centre and the provinces. Transport bottlenecks are to be removed and steps taken to increase the supply of fertilizers, seeds and implements. The activities of the various provinces and states are to be co-ordinated and adjustments made to avoid wastage, overlapping and duplication of effort. Sufficient funds will be placed at the disposal of the Food Commissioner to enable him to carry out the work entrusted to him. This organisation, it is hoped, with the active co-operation of the provinces and states and the people of this country will be able to make the country self-sufficient before the end of the year 1951.

But it is well to recognise that the task is not an easy one and correct planning and hard work lies ahead. If past experience be any guide, certain mistakes which resulted in wastage of huge sums of money on unfruitful ventures should be avoided. Particular care should be taken to see that new lands brought under the plough are cultivated with due regard to the suitability of the crop to be grown on them and also to the status of soil fertility. Except, perhaps, in the West coast the bulk of the uncultivated land in South India is

marginal land and only under extreme conditions like the present will it be worthwhile to cultivate them. With regard to the use of artificial fertilizers though we hold that they have an important part to play in increased food production, it is not to be forgotten that injudicious and unbalanced application of fertilizers will upset the biological equilibrium of the soil and may in the long run deplete the soil of its natural fertility which is an evil to be guarded against at all costs. Improved strains of crops do result in increased returns for a time. In recent times agrobiologists have recognized that improved strains 'run out' after a period and a recognition of this fact is necessary before distribution of any one particular strain is undertaken on a large scale and strains and varieties which have shown signs of decline should be eliminated and new strains substituted. We have thought it necessary to make mention of these facts in order to indicate the magnitude of the task involved so that people may not take a too complacent a view of the situation and take it for granted that somehow things will get adjusted by themselves. Conscious effort on the part of Government and people alike is necessary and the Prime Minister's appeal is meant to make us realise this. This brings us to the question of the part to be played by consumers in solving the food problem. The Prime Minister has appealed to the people to make less demand on rice as it would appear to be the costliest item in our food purchases from abroad. We recognize that it is difficult to change a food habit, but habits are formed and not inherent and a slight adjustment in the daily menu to meet a national emergency should not after all be difficult to a people interested in their country's welfare. Tapioca, sweet potato and plantain have been suggested as alternatives or supplements to a cereal diet. Tapioca, it may be mentioned in this connection, has been the mainstay of the people in the West coast where supplies of rice have been woefully inadequate during the last few years. We have to mention, however, that the vitamin content of these subsidiary foods is inferior to that of rice and steps should be taken to ensure a plentiful supply of vitamins to those who take to the changed diet. This can be done by the manufacture of food yeast on a large scale. The sugar factories which receive protectian to their industry may be asked to undertake this enterprise as a side line and sell the material at a low margin of profit.

An Introduction to the Study of Striga lutea (Lour) as a Root Parasite on Rice in Malabar*

By

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Except the references made in the Editorial note of the Agricultural Journal of India (1906) and by Palm and Heuser (1924) very little is known about the parasitism of Striga on rice. It may possibly be due to the fact that rice is grown essentially under swamp conditions where the parasite cannot thrive. There are however tracts that are infested with Striga lutea as in the Malabar Coast of Madras where rice is grown as a rainfed crop on the slopes of hills (*modan* lands) during the South-west monsoon between June and September.

In the district of Malabar, rice is cultivated mainly in three different classes of land. They are the swamp or the low–lying wet lands, the artificially terraced hill–slopes out-skirting a valley, popularly known as *Palliyal* and the dry hill slopes or the *modan* lands. In the first two classes of land there is flow of irrigation water, although in the latter, this is confined to a shorter period. For this reason, Striga does not occur in these types of land.

In Malabar there are particular areas where the parasite is known to occur year after year, so much so, that the ryots have been forced to give up cultivating rice on such lands. The seriousness of the pest was realised soon after the Agricultural Research Station at Pattambi was opened (Mad. Ag. Stn. Reports, 1928–29). In certain of the fields where the parasite was occurring the crop in the affected and the adjacent non-infested areas was harvested separately and the figures given in the table below show the extent of damage that this parasite can inflict on the crop

Year	Variety	Grain yield per acre in the Striga infested area	Average yield per acre in the pest free area
1930—31	Budama	40 lb	500 lb
1934—35	Modan black glume	83 lb	409 lb
,,	Budama	25 lb	500 lb

The young plants when once attacked by this parasite, make little progress and gradually succumb.

* Part of a Thesis submitted for the M. Sc. Degree by the author.

Striga lutea (*Theepalli*—Malayalam) parasitic on rice plant at the Agricultural Research Station, Pattambi can be briefly described as an erect, branching, stiff herb of the Natural Order *Scrophulariaceæ* growing 6–15 inches high. Stem is slender, four-sided and hairy. Leaves are linear, very narrow, about half inch long, entire, sessile, arranged opposite below, and alternate opposite above. Flowers are many, white or yellowish, tubular with spreading limbs, epigynous, axillary and in the upper, either solitary or in lax bracteate spikes. Calyx is tubular and five-toothed. Tube is curved at the tip and the corolla four-lobed. Stamens are didynamous and epipetalous. Fruit is oblong, cylindric and one-fourth inch long.

Distribution of Striga lutea in Malabar with Special Reference to Walluvanad Taluq

Striga was known to be prevalent in a virulent form particularly in Ernad and Walluvanad taluqs, two out of the eight taluqs constituting the district of Malabar. A survey of this root parasite on rice was undertaken by the author in the *modan* areas of the Walluvanad taluq, wherein the Pattambi Agricultural Research Station is situated and the infestation was found to be universal though varying in intensity. In the Pattambi and Mannarghat firkas, two of the six firkas which go to make up this taluq, a fairly high degree of infestation was noticed. In very severe cases of attack the damage to the rice crop as judged by the eye on a comparison with the standing crop in the adjoining non-infested fields was estimated to be very considerable. In some of the firkas like the Mankada and the Sreekrishnapuram the introduction of this pest appears to be comparatively of recent times It may be that *modan* cultivation in these areas was taken up only very lately. The existence even now in the surroundings of these *modan* lands of vast jungle areas fit for rice cultivation when cleared is in itself sufficient proof for this. The two firkas exhibiting the worst form of attack must have been the earliest to take the infection. It is generally noted that in a given area of *modan* cultivation, when Striga is detected in any odd corner, then necessarily the whole area is found infested. In a village, the rice cultivation is not, as a rule confined to a single consolidated area. Rice fields invariably are scattered in different localities separated from one another by garden lands, a barren hillock or a waste jungle. If Striga is noticed in any one field one could almost be sure that this could be traced, more or less, in all the other fields in that village. In the one case, the spreading of infection may mostly

be by wind disseminating the seed while in the other, it may be through the contaminated rice seed imported from the infected area. Facilities for cheap and easy transportation of seed largely available in recent years in the interior of the villages must mainly be responsible for such wide distribution of this pest. One thing however noted, has a special significance. It is seen that infection of Striga is very little, practically nil, among rice fields in the northern taluqs of Malabar as compared with her southern taluqs. In fact, as one proceeds from the far South towards the northern portions of Malabar, there is a gradual diminution in the infection, the most severe infection being confined to the *modan* lands in the southern end of Malabar. Hence it is reasonable to suppose that the original home of infection in Malabar is in the south and that this has gradually spread northwards.

In places of low infection met with in the Walluvanad taluq there is a risk of the infestation assuming alarming proportions unless serious attempts are made to exterminate this pest. Of a total area of 183,022 acres reported to be under the wet, *palliyal* and the dry cultivation in this Taluq during the year 1935—36, 101,239 acres were under the dry cultivation alone. It therefore becomes clear that, should this pest have such an unrestrained spread, there is no doubt that it will be a serious menace to the *modan* rice cultivation. It is a common sight to observe in the midst of *modan* rice fields infested with the parasite several patches either with little or no plants surviving or with plants, sickly and poorly developed, contributing practically nothing to the yield. These patches when closely examined reveal dense colonies of Striga. The affected host plants present a blighted appearance, a phenomenon characteristic of what is implied by the vernacular name given to the parasite.

Observations on the Incidence and the Morphology of Striga

Several of the minute striga plants when they are first observed emerging from the soil are found to possess well-developed non-pigmented underground stems. Observations recorded at this station have shown that the maximum height of a single mature plant measures 18·5 inches and possesses 15 pairs of well defined leaves and 14 pairs of capsules. The average height to which the Striga grows in the *modan* land could be set at 8 inches. In a colony of Striga, what appears to be independent plants above surface are sometimes only branches arising from a single stock. In a single plant there

may be as many as 60 branches and there may be as many as 200 plants in a single square foot of area. The underground stem is sometimes three or more inches long. As a rule, the underground stem does not extend below a two-inch-depth of the soil.

The general flowering under field conditions at the Agricultural Research Station, Pattambi has been observed to commence from the middle of July. Up to 15 pairs of capsules have been counted for a single plant. A single capsule on an average formed 600 seeds though it has been stated (Tadulingam & Narayana, 1932) that there may be as many as 50,000 seeds produced by a single plant. The seeds are very minute, avoid and striated and are held in the innumerable flaps or folds provided in the free central placenta. A seed measures on an average 313 $\mu \times 187 \mu$. The same authors have stated that the seed can remain viable for 40 years and more

For a Striga plant emerging from the top layer of the soil, it takes about two months from appearance above ground to the bursting of the last capsule borne by it. The period of life above ground may therefore, within limits, get appreciably modified according to the depth to which the seed remains stationed in the soil. This probably accounts for the flowering in Striga noticed to take place sometime after a week from emergence and in several other cases even before. Pearson (1913) in his studies on the underground growth and development of Striga assigned about seven weeks for the sub-terranean growth period of a particular Striga plant under observation. It is thus evident that besides other factors like soil moisture, the main condition that influences the life period of the Striga above ground is the depth at which the seed remains deposited. This does not mean that it is only the seeds that remain in the first few inches of the soil layer that give rise to the plants. Experiments have shown that seeds even in the deeper layers of the soil can germinate and produce plants. In a pot-culture experiment conducted by the author during the year 1935 a Striga seed was noticed to germinate even at 6 inches depth from the top surface. The young plant, however, could not push through the mass of soil on the top and did not develop beyond a certain stage. This therefore lends support to the view that only seeds within the top layer of the soil generally germinate and grow into overground plants and that the innumerable seeds lying within the confine of the sub-soil, if they germinate, produce young plants that are but short-lived. Such plants though they may not make much progress have to make use of the host plant for their existence and this

probably accounts for the sudden running down in condition of the rice plants in a Striga infected field though there may not be many Striga plants visible above the surface of the soil. For its metabolic activities the parasite Striga has to depend entirely upon its host when it is underground. When above ground, its dependence on the host is only partial as it makes its own plant food by photo-synthesis out of raw materials drawn from the host. Its development above ground, nevertheless, is mainly for its reproductive function.

Summary and Conclusions

Very little literature on the parasitism of Striga lutea on rice is available. A brief account of the main cultural practices of rice cultivation in Malabar is given to show their relation to the incidence of Striga. The seriousness of the menace of Striga on *modan* rice in Malabar is emphasized. A brief description of the parasite as it appears in the rice fields in Malabar is given. The whole of the Walluvanad taluq in the Malabar District of Madras is infested with the parasite S. lutea. There are evidences to indicate that the original home of infection with Striga in Malabar is in the far South and that this has gradually spread North. The observed variation in the time of flowering among the Striga plants may be due to the varying terms of life period spent by them below ground. The sudden running down in condition of the rice plants, when the visible Striga plants are only few, may be due to the parasitism by underground Striga. When underground Striga behaves as a total parasite, while above ground, it conducts itself as a partial parasite, its growth activity then being mainly directed towards its reproductive functions.

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Influence of Agronomic Factors on the Time of Flowering of Rice

By

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Introduction: *Flowering duration* of rice as defined in terms of the number of days that elapses from the date of sowing to the date of flowering, is an important varietal character though with wide variations; some of the cultivated rices mature within 50 days while the longest of them takes well over 150 days from sowing to flowering. It is observed that earliness and lateness constitute a pair of contrasting heritable characters, their behaviour in inheritance being simple or complex according to the genetic make-up of the parents involved. While this is true of the varieties native to a tract, instances are commonly found of varieties changing their duration when introduced into another tract with differing climatic conditions. Ramiah (1927) has recorded some outstanding examples of such changes in duration in the Province of Madras as also cases of constancy wherein the duration remains unaltered despite chanaes in climatic environment.

Within the same tract again, varieties fall under two important groups; the time-limited varieties which come to flower within a definite period irrespective of the season of sowing and season-limited varieties which flower only in a particular season of the year, their duration getting extended or reduced according as they are sown early or late. Even in a particular season in which a variety, whether season-limited or time-limited, is grown, changes in the time of flowering as well as in the period of flowering are noticed as a result of agronomic factors like time of sowing, age in the nursery, spacing given in the field, application of manures etc. This paper embodies some typical examples of such changes in the time and period of flowering recorded in the course of various field experiments (randomized replicated trials) conducted for over a decade at the Agricultural Research Station, Pattambi on the west-coast district of Malabar. *Time of flowering* herein refers to the date on which more than 75% of the plants in a population comes to flower and the *period of flowering* to the number of days that elapses between the commencement and completion of flowering in a given strip or clump of plants.

Varieties and Seasons: In the typical swamp soils of Malabar rice is cultivated in three seasons:— 1. First crop or the autumn rices grown from April — May to September — October. 2. Second crop or winter rices from September — October to December — January, and 3. Third crop or spring rices that are raised in limited areas with facilities for lift irrigation from February to May. The autumn rices are either broadcast or transplanted (major area being broadcast) while the winter and spring rices are as a rule transplanted. Monthly sowing trials with ten of the most popular varieties have indicated that the second-crop varieties and the long-duration first-crop varieties are season-limited while the short-duration first-crop varieties like PTB. 7, 8 and 9, tend to be time-limited along with the well-known cosmopolitan strain PTB. 10., which is pre-eminently time-limited and is generally raised in all the three seasons.

Experimental: *Broadcasting versus transplanting*: As indicated above, the autumn rices are sown broadcast with the early rains or sown with the early rains in a nursery and transplanted. Dates of flowering were observed in two series of experiments in one of which strain PTB. 1 with season-limited flowering was broadcast at three intervals and planted in one batch, the date of broadcast sowing being determined by the fall of adequate showers from April onwards. The second experiment comprised of one batch of sowing and one of transplanting with nursery sown on the same day of broadcasting, with strain PTB. 9. The experiments were conducted for three seasons. The results given in tables I and II indicate that even with a difference of 1 to 1½ months in the time of broadcast sowings, the flowering dates fall within a period of three weeks, the duration decreasing from an average of 140 days to 110 days. For the same dates of sowing the transplant crop flowered later than broadcast crop except in one season. This is confirmed in all the seasons in the second experiment where the transplant crop flowered 7 days, 6 days and 4 days later than the corresponding broadcast crop.

TABLE I

PTB. I. —Broadcast at intervals and transplanted

	Date of sowing		Time of flowering	Duration in days
1936—'37				
1. Broadcast	6—4—36		29—8—36	145
2. do.	15—5—36		4—9—36	112
3. do.	21—5—36		7—9—36	109
4. Transplant	15—5—36	(planted 17—6—36)	4—9—36	112

	Date of sowing		Time of flowering	Duartion in day
1937—'38				
1. Broadcast	27—4—37		30—8—37	126
2. do.	20—5—37		7—9—37	110
3. do.	28—5—37		14—9—37	109
4. Transplant	20—5—37	(planted 28—6—37)	11—9—37	114
1938—'39				
1. Broadcast	17—4—38		27—8—38	132
2. do.	26—4—38		29—8—38	125
3. do.	14—5—38		8—9—38	117
4. Transplant	26—4—38	(planted 9—6—38)	7—9—38	134

TABLE II

PTB. 9. —Broadcast and transplanted

	Date of sowing	Date of planting	Time of flowering	Duration in days
1942—'43				
1. Broadcast	27—4—42		11—8—42	106
2. Transplant	do.	17—6—42	18—8—42	113
1943—'44				
1. Broadcast	23—4—43		8—8—43	107
2. Transplant	do.	30—5—43	14—8—43	113
1944—'45				
1. Broadcast	7—5—44		17—8—44	102
2. Transplant	do.	14—6—44	21—8—44	106

(b) Age of seedling: Observations on flowering were continued in the experiments with different ages of seedlings for an ordinary transplant crop during first, second and third crop seasons.

In the first series of experiments three varieties were sown in three batches of sowings and all planted on the same day in the normal season. In the second series different ages of seedlings from 65 to 25 days were combined with different batches of plantings at intervals of 10 days. In the second crop season, the experiment was conducted for three seasons in two series, the first series was sown at intervals of 10 days and the seedlings planted on the same day and the second series sown on the same day was planted at intervals of 10 days. In the first, the age of seedlings gets reduced from 60 to 30 days by virtue of the difference in time of sowings while in the second series the age gets extended from 30 to 60 days as a result of delayed plantings. In the third crop season the time-limited variety PTB. 10 was sown on the same day and planted at intervals of 5 days, thus increasing the age in nursery from 15 to 55 days. As the flowering was found to be protracted in certain strips the period of flowering was also noted in this case. Experimental details and results are given in tables III to VI below.

TABLE III

Strains PTB. 1, 2 and 5 sown at different times and planted on the same day

	Date of sowing	Date of planting	Age in nursery in days	Time of flowering.	Duration in days
1945—'46					
PTB. 1.	4—4—45	15—6—45	72	3—9—45	152
	19—4—45	do.	57	6—9—45	140
	25—5—45	do.	21	9—9—45	107
PTB. 2.	4—4—45	do.	72	28—8—45	146
	19—4—45	do.	57	29—8—45	132
	25—5—45	do.	21	4—9—45	102
PTB. 5.	4—4—45	do.	72	31—8—45	149
	19—4—45	do.	57	2—9—45	136
	25—5—45	do.	21	7—9—45	105
1947—'48					
PTB. 1.	24—4—47	10—6—47	47	6—9—47	135
	8—5—47	do.	33	do.	121
	24—5—47	do.	17	10—9—47	109
PTB. 2.	24—4—47	do.	47	27—8—47	125
	8—5—47	do.	33	29—8—47	113
	24—5—47	do.	17	4—9—47	103
PTB. 5	24—4—47	do.	47	1—9—47	130
	8—5—47	do.	33	5—9—47	120
	24—5—47	do.	17	8—9—47	107

Results are similar to those obtained in the case of broadcast sowings; irrespective of a long interval in the times of sowing the flowering dates fall close together.

TABLE IV

PTB. 2. —Different ages in 4 batches of plantings

Date of sowing	Time of flowering	Age in days	Duration in days	Time of sowing	Time of flowering	Age in days	Duration in days
	I. planting 10—6—'47				**II. planting 20—6—'47**		
25—4—47	25—8—47	45	122	25—4—47	30—8—47	55	127
5—5—47	do.	35	112	5—5—47	1—9—47	45	119
15—5—47	30—8—47	25	107	15—5—47	2—9—47	35	110
25—5—47	*	*	*	25—5—47	8—9—47	25	106
	III. planting 30—6—'47				**IV. planting 10—7—'47**		
25—4—47	30—8—47	65	127	*	*	*	*
5—5—47	do.	55	117	5—5—47	6—9—47	65	124
15—5—47	1—9—47	45	109	15—5—47	8—9—47	55	116
25—5—47	9—9—47	35	107	25—5—47	9—9—47	45	107

* Seedlings over 65 days and under 25 days were not planted.

For the same date of planting the duration gets reduced with decreasing age in the nursery and for the same age it gets reduced with delayed plantings. In the second batch of planting for instance, the flowering duration gets reduced from 127 days to 106 days; for an age of 45 days, the duration of 122 days in the first planting falls to 107 days in the fourth batch of planting.

As regards time of flowering, it is delayed for the same date of planting as the age in nursery gets reduced and is also delayed with advancing season with a difference of 15 days in flowering for a delay of 30 days in the time of planting.

TABLE V.

Second crop PTB. 3 sown and planted at 10 days intervals

	Date of sowing	Date of planting	Age in days	Time of flowering	Duration in days
1935—36	10—8—35	9—10—35	60	24—12—35	136
	20—8—35	do.	50	do.	126
	30—8—35	do.	40	do.	116
	9—9—35	do.	30	do.	106
	do.	19—10—35	40	20—12—35	102
	do.	29—10—35	50	24—12—35	106
	do.	8—11—35	60	26—12—35	108
1936—37	12—8—36	12—10—36	60	8—12—36	118
	22—8—36	do.	50	do.	108
	1—9—36	do.	40	13—12—36	103
	11—9—36	do.	30	14—12—36	94
	do.	22—10—36	40	21—12—36	101
	do.	1—11—36	50	24—12—36	104
1937—38	11—8—37	10—10—37	60	10—12—37	121
	21—8—37	do.	50	9—12—37	110
	31—8—37	do.	40	10—12—37	101
	10—9—37	do.	30	do.	91
	do.	20—10—37	40	17—12—37	98
	do.	30—10—37	50	23—12—37	104
	do.	9—11—37	60	27—12—37	108

The results show that, provided the planting is done in the season, for the same date of planting, even a difference of 30 days in the age of the seedling does not materially affect the time of flowering, all the lots coming to flower on the same date, while delayed plantings delay the time of flowering. Here, in the second-crop season, the age in nursery has far less effect on the time of flowering than in the first-crop season.

TABLE VI

Third crop—PTB. 10. sown on the same day and planted at intervals.

Date of sowing	Date of planting	Age in days	Time of flowering	Duration in days	Period of flowering
29—1—40	13—2—40	15	10—4—40	72	5
do.	18—2—40	20	10—4—40	72	7
do.	23—2—40	25	12—4—40	74	9
do.	28—2—40	30	19—4—40	81	9
do.	4—3—40	35	20—4—40	82	15
do.	9—3—40	40	20—4—40	82	15
do.	14—3—40	45	20—4—40	82	16
do.	19—3—40	50	22—4—40	84	17
do.	24—3—40	55	22—4—40	84	17

For this variety in the third-crop season, an age of 20 to 25 days in the nursery is the optimum. Beyond that the flowering gets shifted by about a week and remains more or less steady within the age group 30 to 55 days. Here however, the flowering is observed to be protracted, the period of flowering extending to 17 days in the case of seedlings aged 50 to 55 days.

(c) Spacing: A number of experiments were conducted at the Agricultural Research Station, Pattambi, as elsewhere in the Province of Madras, giving different spacings to rice seedlings at planting and the data published hitherto refer exclusively to the influence of spacing on the yield. In the course of a series of such experiments it was noticed every year and in every season that the time of flowering was also changed as a result of spacing. Close-spaced plots were inclined to be early and uniform, whereas as spacing was increased the trend was towards delay in the time of flowering. Typical examples of such changes in time of flowering are given below for first and second-crop seasons. In one experiment different spacings from 3″ x 3″ to 12″ x 15″ were adopted, keeping the number of seedlings per hole constant. In the second series the spacings were increased from 3″ x 3″ to 12″ x 12″ and the number of seedlings in each hole is also increased from 1 to 4.

In these experiments it was also noted that the most vigorous seedling in a bunch of seedlings flowered first while others took more time and the tillers they produced subsequently still more time to flower, the tillering and consequent .protraction in flowering being induced by wide spacings between the clumps. In order to study in detail the sequence of flowering, six clumps were marked out at random

in the experimental sub-plots in one of the experiments during first and second crop seasons and the average interval between the time of flowering of the first and the last tiller in the clump (period of flowering) noted. Results are given in the tables below :

TABLE VII

Different spacing with number of seedlings per hole constant

First Crop—PTB. 9 Second Crop—PTB. 3

Spacing	Number of Seedlings	Time of flowering	Duration in days	Period of flowering	Time of flowering	Duration in days	Period of flowering
3 x 3 inches	2	26—8—39	111	3	14—12—39	97	2
3 x 6 ,,	2	27—8—39	112	8	15—12—39	98	8
6 x 6 ,,	2	29—8—39	114	8	16—12—39	99	10
6 x 9 ,,	2	30—8—39	115	10	17—12—39	100	17
6 x 12 ,,	2	29—8—39	114	11	...	100	18
12 x 9 ,,	2	1—9—39	117	12	19—12—39	102	21
12 x 12 ,,	2	2—9—39	118	13	22—12—39	105	26
12 x 15 ,,	2	3—9—39	119	14	24—12—39	107	28

TABLE VIII

Different spacing with varying number of seedlings

First crop—PTB. 5. Second crop—PTB. 4.

Spacing	Number of seedlings	Time of flowering	Duration in days	Time of flowering	Duration in days
3 x 3 inches	1	10—9—43	130	27—12—42	111
...	2	...	130	25—12—42	109
...	3	...	130	...	109
...	4	9—9—43	129	24—12—42	108
4 x 4 ,,	1	12—9—43	132	28—12—42	112
...	2	...	132	27—12—42	111
...	3	9—9—43	129	25—12—42	109
...	4	8—9—43	128	26—12—42	110
6 x 6 ,,	1	12—9—43	132	1— 1—43	116
...	2	...	132	28—12—42	112
...	3	11—9—43	131	27—12—42	111
...	4	10—9—43	130	...	111
8 x 8 ,,	1	13—9—40	133	3—1—43	118
...	2	13—9—43	133	1— 1—43	116
...	3	12—9—43	132	29—12—42	113
...	4	10—9—43	130	...	113
12 x 12 ,,	1	14—9—43	134	7—1—43	122
...	2	14—9—43	134	4—1—43	119
...	3	12—9—43	132	2—1—43	117
...	4	12—9—43	132	...	117

The foregoing results would show that the flowering time tends to get delayed as the spacing is increased and that the delay is less when the number of seedlings per hole is increased. The period also gets lengthened as the spacing is increased and the differences in both time and period of flowering between different spacings are more distinct in the second-crop season than in the first-crop season. It must be mentioned here that the date of flowering in bunch planting denotes the date on which the more vigorous seedling in more than 75% of bunches in the sub-plot came to flower and not the date of flowering of all the seedlings in the individual bunches.

(d) Manures: It is common observation that heavy dressing of manures delay the time of flowering in most of the varieties but ordinarily the shift in time is not more than two or three days at the most. Marked deviation however, in the time of flowering was noticed in the manurial experiments with wood ash when it was applied to transplant fields at the fairly high rate of 4,000 lb. per acre either alone or in combination with other manures like green leaf, groundnut cake etc. Experimental details and results are given below :

TABLE IX

Treatments :

1. No manure (Control)
2. Wood ash at 4000 lb. per acre.
3. Wood ash at 4000 lb. plus leaf at 4000 lb. per acre.
4. Leaf at 4000 lb. per acre.
5. Wood ash at 4000 lb. plus groundnut cake at 4000 lb. per acre.
6. Groundnut cake 400 lb per acre.

Year	Treatments	First crop—PTB. 14. Time of flowering	Duration in days	Second crop—PTB. 4. Time of flowering	Duration in days
1943—44	1	25—8—43	116	2—1—44	127
	2	20—8—43	111	31—12—43	125
	3	21—8—43	112	1—1—44	126
	4	24—8—43	115	1—1—44	126
	5	20—8—43	111	31—12—43	125
	6	25—8—43	116	...	125
1944—45	1	25—8—44	99	19—12—44	111
	2	21—8—44	95	19—12—44	111
	3	21—8—44	95	19—12—44	111
	4	23—8—44	97	19—12—44	111
	5	21—8—44	95	20—12—44	112
	6	24—8—44	98	20—12—44	112

The time of flowering in the first-crop season is advanced by about a week by the application of wood ash at 4,000 lb. per acre alone or in combination with leaf or cake, while it has very little effect during the second-crop season.

4. Discussion: From the periodical broadcasting experiments it is seen that the flowering is delayed as sowing is delayed but the shift in time of flowering is not in direct proportion to the length of sowing intervals. For a difference of 30 days in the dates of sowing, for instance, the corresponding difference in flowering is 15 days or less. This would show that up to a particular period within the season, weather favours vegetative growth while in the later stages it is predominantly conducive to flowering. For the same date of sowing for the broadcast and transplant series, flowering is found to be delayed in transplant crop (vide Table I and II). Only in one out of six seasons of trial have the transplant and the broadcast crops flowered on the same date. These results are at variance with those obtained in Coimbatore where, the flowering of the transplant crop was found to be sharp and uniform while in the broadcast crop it was uneven and delayed (Ramiah and Hanumantha Rao, 1936.)

It is also found that the flowering was not affected if planting was done on the same date in the season whatever the age in the nursery, but in delayed plantings the earlier the planting the earlier was the flowering. These results are more or less similar to those obtained in the experiments conducted at Coimbatore (Ramiah, K. 1936). In the first-crop season, however the flowering is also found to be delayed with decreasing age in the nursery i. e., the older the seedlings the earlier was the flowering. It may be mentioned that both in the first and second-crop seasons, the crop yield suffers if planting is delayed irrespective of the growth of seedlings, the time of planting having a greater influence in maintaining yields than age in nursery. In the light of the above findings, the *duration* generally specified for a variety should be considered as the *minimum period of time* required for it to give its natural yield within a particular season.

Of all the agronomic factors spacing is found to have the maximum effect on the time of flowering. It is delayed as the spacing is increased and in wider spacing it is possible to check the delay if the number of seedlings per hole is also correspondingly increased. Ramiah has observed that when extra spacing between plants was given the *period* between which the flowerings commenced and finished as much as three weeks. This *period* which in the

above experiments had gone up to four weeks, could be reduced only to a limited extent by increasing the number of seedlings per hole. It is found that the age of seedlings also affects the period of flowering (vide Tables VI and VII). There are rices which have an inherently protracted period of flowering (long period) and from the agronomic point of view the variety that starts and finishes flowering in a minimum period (short period) is always to be preferred. (Ramiah 1927). Pattambi strains PTB. 15 and 16 are typical examples of the former while all the rest of the strains belong to the short period group. Protracted flowering is found to be characteristic of some varieties and is probably a heritable feature. While it is possible to induce this long-period nature in otherwise short-period varieties by nature in this case by wide spacing of plants, close planting in bunches is ineffective in bringing about sharp flowering in 'long period' varieties. A study therefore, of the 'short period' flowering in 'long period' varieties would prove very useful as also varietal studies with special reference to the inheritance of this character.

While heavy dressing of most of the manures tend, if at all, to shift the flowering towards lateness, wood ash at 4000 lb. per acre (100 lb. K_2O) was found to hasten it by four to five days in the first-crop season. No such effect was noticed in the second-crop season. In previous experiments also, wood ash at 1000, 2000 and 3000 lb. per acre did not show any marked difference in flowering nor did potassium sulphate to supply 60 lb. K_2O per acre. Whether the effect on flowering is due to potash and if so its ceiling dose beyond which flowering gets shifted can be assessed only after further trials with wood ash and potassium sulphate at high incremental doses.

5. Summary

1. The effect of different agronomic influences on flowering in rice was studied for a number of seasons.

2. In broadcast sowing at different intervals, flowering is delayed with delayed sowing; the dates of flowering fall at shorter intervals than the dates of sowing. These narrow shifts in time of flowering are attributed to the later weather conditions which are more favourable to flowering.

3. For the same dates of sowing, for broadcast and transplant crop flowering in transplant plots tends to be delayed, unlike the results obtained at Coimbatore.

4. In delayed plantings, with different ages of seedlings the earlier the planting the earlier was the flowering; in the first-crop season it was earlier with older seedlings as well.
5. Spacing is found to have the maximum effect in changing the time of flowering as also the period, the time approaching that of close planting to a limited extent with increase in the number of seedlings.
6. Wood ash at the fairly high rate of 4,000 lb. per acre is found to hasten flowering by about a week in the first-crop season while it has no effect in the second-crop season.
7. The need for further experiments is pointed out and future line of work suggested as regards inheritance studies with reference to flowering habit as also regarding the influence of potash on the time of flowering of rice.

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A Note on Pre-Soaking in Phosphate Solutions for Increasing Yield in Rice

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In recent years research is being directed towards a more efficient utilisation of fertilizers for inrceasing crop production. Various methods of applying fertilizers, differing from straight placement, but with the same object in view, of making available a larger quantity of nutrient elements to the growing plant have been tried. The literature on this aspect of fertilizer research has been very ably summarised in Soils & Fertilizers, Vol. 10, (1947). Among these various methods, coating the seeds with fertilizers before sowing is one and Gusev (1940) has claimed that, by treating cereal and other seeds with phosphates before sowing, either by moistening with a solution of phosphate fertilizer or by coating with a mixture of starch paste and fertilizer, the plants were able to utilise as much 70–80 per cent of the phosphate supplied. The possibilities of this method of pre-soaking seed in nutrient solutions, both as a means of supplying major elements like phosphorus and potassium and as a means of rectifying trace-element deficiencies have been explored in England by Roach and Roberts (1949). The most important result was observed in the case of oats, by soaking it in about one-third of its weight of 21 per cent tri-basic potassium phosphate solution and sowing the seed in phosphate-deficient soil. The yield from untreated seed was 17 bushels per acre, from water-soaked 20, and from phosphate-soaked seed. 25 bushels to the acre, with correspondingly large increases in straw. Similar large increases in yield were recorded in the case of other cereals, like wheat and barley, though the optimum concentration of the phosphate solutions were different. It was observed that the phosphate imbibed by the seed was deposited mainly in the husk, from where it could easily be washed off by running water. A similar promising result was also found in an experiment on oats grown in a manganese-deficient soil suggesting that a large part of the *Mn* requirement in oats could be provided by soaking the seed before sowing, in suitable dilutions of manganese salts.

In view of the obvious convenience, cheapness and adaptability of this technique of pre-soaking and since the method, if substantiated on other crops in large-scale field trials would be of very great practical value for Indian conditions, certain preliminary studies were started at Coimbatore on paddy, groundnut and cowpea, in pot-cultures to see how far the growth and yields of these crops could be improved by using the pre-soaking technique. The results that are available in the case of paddy appear to be of sufficient interest to merit publication for the information of other workers elsewhere who might be contemplating similar trials.

Material and Methods

A short-duration paddy variety Co. 13 was chosen as suitable for sowing in February. A number of treatments, using two concentrations, 10 and 20%, of three kinds of potassium phosphate were tried in addition to soaking in mere distilled water. Incidentally an attempt was also made to see how for pre-soaking in different strengths of a growth-promoting hormone, beta-indolyl-acetic acid, would affect the growth and yields as compared to soaking in phosphate solutions. The seeds were soaked in a third of their weight of solution, care being taken to see that all the liquid was absorbed by the seed within 24 hours. The seed was then air-dried to its original weight, by spreading it thin in a wide stray, with occasional turnings to ensure uniform drying. The seeds were sown in 10″ x 10″ glazed pots holding about 30 pounds of soil, at the rate of two per hole and twentyfive holes per pot. After germination the plants were thinned out in three stages before flowering so as to have a uniform stand of ten plants per pot for flowering and yield records. When ripe the plants in each pot were harvested, separated into grain and straw and weighed, once to get the fresh weight and again after complete drying, to secure dry weight records. The material thus gathered is being utilised for chemical analysis to see if any difference exists in the phosphate or potash content of plants from treated and control seed.

The results so far as they relate to growth and yield in paddy are summarised in the table attached.

It would be clear from the data that pre-soaking the seed in tri-basic potassium phosphate has resulted in a better growth than soaking in solutions of the other two salts, mono-basic and di-basic potassium phosphates. With tribasic phosphate itself, a higher

strength seems to be more helpful than a lower one. The grain yield in treatment 8, (soaking in 20% tribasic phosphate solution) is nearly 40 per cent more than in control, while it is only 21% more in the case of treatment 7, (soaking in 10% solution.) Pre-soaking in beta-indolyl acetic acid has also improved the grain yield significantly, but there is no great difference in effect between ten and twenty parts per million concentrations. Pre-soaking in mere distilled water has had no effect on grain yield if done once (treatment 1), but a repetition of the process (treatment 2) has a definitely adverse effect on both grain and straw. A combination of presoaking in phosphate solution and vernalisation in continuous light for two weeks (treatment 13) did not show any beneficial effect on grain or straw yield, although the tillering appeared to be improved. Further work is needed for determining the factors involved in this mutual annulling effect of two methods, each of which is individually beneficial in improving yields

In regard to plant height, soaking in tri-basic phosphate has produced the tallest plants, with the 20% treatment better than 10%, but this is counter-balanced by a poorer tillering in the former so that the straw yield in treatment 8, is less than in treatment 7. Straw yields in general do not seem to be improved much by any of the phosphate soakings; nor is there any perceptible effect in flowering earliness.

Summary

The results obtained from a preliminary pot-culture study on the effect of pre-soaking paddy seed in phosphate solutions are presented and discussed. Soaking the seed in a 20 percent solution of tri-basic potassium phosphate showed an increase of 38·8% in grain yield over control and a 21·1% increase after soaking in a 10% solution.

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TABLE

Effect of Pre-soaking Paddy Seed in Phosphate solutions

Pot-Culture Experiment in 10" x 10" glazed pots ... Variety—Co. 13
13 Treatments, replicated 4 times, each in 2 soils ... Sown on 28—2—1949.
Complete, (NPK) and phosphate-deficient, (NK) ... Flowered — May, 1949.
From the Permanent Manurial plots ... Harvested — 8—6—1949

(a) Summary of Results, from both soils types, NPK and NK

No.	Treatments	GRAIN YIELD. Mean per pot (gms.)	% on Control 100	STRAW YIELD. Mean per pot (gms.)	% on Control 100	Plant Height (gms.)	Tillering	Flowering (days)
1	Soaked—and dried in 1/3 weight of seed of distilled water—once	21·35	94·5%	37·39	70·2%	98·1	2·9	76
2	,, —thrice	17·50	77·5%	33·00	63·6%	94·6	2·8	79
3	,, KH_2PO_4 — 10%	21·35	94·5%	45·50	84·7%	99·2	3·4	77
4	,, ,, 20%	20·88	92·4%	58·44	112·7%	101·1	3·5	77
5	,, K_2HPO_4 — 10%	22·10	97·8%	51·25	98·8%	104·5	3·2	80
6	,, ,, — 20%	25·06	110·9%	48·63	93·8%	103·0	2·8	77
7	,, K_3PO_4 — 10%	27·36 *	121·1%	57·26	110·4%	106·0	3·3	77
8	,, ,, — 20%	31·35	138·8%**	52·58	101·4%	109·5**	3·0	76
9	,, beta—indole acetic acid 10 p.p.m.	26·86 *	118·9%	45·78	88·3%	102·1	3·0	74
10	,, 20 p.p.m.	26·50 *	117·3%	51·12	98·6%	104·3	3·4	74
11	**Control** — dry seed	22·59	100·0%	51·86	100·0%	98·8	3·6	77
12	Soaked 24 hours before sowing	21·00	93·0%	52·74	101·7%	101·3	3·0	76
13	Continuous light for 14 days, in conjuction with soaking in 2% K_3PO_4 solution	19·34	85·6%	51·89	100·1%	94·9	4·6	78
	Whether statistically significant or not	Very	highly	significant		Yes	Yes	No
	Critical difference — 1% level	5·27 gms.	23·3%	11·67 gms.	22·5%	81 cm.	0·6	
	,, 5% level	3·20 gms.	14·2%					
	(b) Effect of Soil							
	Complete (NPK) soil	25·78	gms.	54·02	gms.	100·3 cm.	3·6	76·5 days
	P-deficient (NK) soil	20·87	,,	43·98	,,	102·3 cm.	2·7	77·4 days
	Whether significant or not	Yes		Yes		Yes	Yes	No
	Critical difference 1% level	2·07	gms.	4·58	gms.	3·2 cm.	0·2	

Note:—* Superior to control at 5% level.
** ,, at 1% level.

Turmeric Cultivation

By

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Introduction: Turmeric is one of the important commercial crops in Madras Province cultivated for the underground rhizomes. The cured rhizomes commonly known as turmeric is used for culinary purposes in Indian house-holds. It is also used for toilet purposes by Hindu women in South India, more particularly in Andhra-Desa. It is exported to foreign countries to some extent for the manufacture of dyes. Turmeric is an exhausting crop and responds very well to manuring and irrigation. Under ideal soil conditions and intensive cultivation, it is a highly remunerative crop. It comes up well in rich loamy soils that are friable and have a good natural drainage. Turmeric cultivation is therefore confined to certain favoured localities, where the cultivation of the crop, the processing of the rhizomes and marketing tend to get specialised.

Distribution: Turmeric is grown in Malabar, Guntur, Krishna, Cuddapah and Coimbatore Districts. The area under this crop in other districts is negligible.

Acreage as Per Season and Crop report 1946—'47.

Districts	*Acres*
Malabar	7,105
Guntur	7,686
Krishna	2,976
Cuddapah	2,739
Coimbatore	2,262
All other districts	4,999
Total ...	27,767

In the three districts where the survey was conducted, the cultivation of the crop is restricted to a few taluks, as shown below :—

Guntur District	*Acres*
Tenali taluk	4,474
Guntur taluk	2,771
Repalli Taluk	321
Krishna District	*Acres*
Bezwada taluk	1,646
Gannavaram taluk	1,000
Divi taluk	188

Cuddapah District	*Acres*
Proddatur taluk	961
Cuddapah taluk	638
Sidhout	485
Rajampet	376

Soils: Turmeric is grown generally in the black clay loams called "Regada" lands in the districts surveyed, excepting in parts of Cuddapah. In Rajampet, Cuddapah and Proddatur taluks, turmeric soils are light black or grey in colour, and they are called "Tuvva" lands. Turmeric is also grown in red soils in the Kodur tract of Cuddapah district. Turmeric crop is raised in wet lands that are in a high level, from which water could be drained during the rainy months. In a few places turmeric is also grown in dry lands having good irrigation facilities.

Rotation: The crop is largely cultivated in high level wetlands where it is rotated with other wetland crops such as paddy, sugarcane, plantain, yam, dioscorea, betel-vine and vegetables. In garden lands, it is rotated with other dry and garden land crops such as dry paddy, maize, redgram, gogu, gingelly, ragi, korra and sajja.. A two or three-course rotation is the general practice depending upon the size of the holding. However, the ryots believe that the longer the interval betwcen successive crops of turmeric, the better it would be for the soil and for the crop.

The following are the rotations followed in general:

Wet lands

(1)	I. Crop ...	Turmeric.
	II. Crop ...	Paddy followed by a pulse.
	III. Crop ...	Plantain, sugarcane, root crops, vegetables, or betel-vine.
	VI. Crop ...	Turmeric, or Ratoon crops of sugarcane, plantain or betel-vine.

Garden lands

(2)	I. Crop ...	Turmeric.
	II. Crop ...	Redgram mixed with dry paddy, maize or groundnut.
	III. Crop ...	Turmeric.
(3)	I. Crop ...	Turmeric.
	II. Crop ...	Early gingelly followed by horse-gram, or a fodder crop.
	III. Crop ...	Redgram mixed with dry paddy, gogu or maize.
	IV. Crop ...	Turmeric.

*(4)	I. Crop	...	Turmeric.
	II. Crop	...	Ragi, Korra, Sajja, or paddy.
	III. Crop	...	do do do do
	IV. Turmeric.		

*NOTE: *This rotation is followed in Rajampet taluk and all the crops are irrigated.*

Mixtures: Turmeric is grown only as a pure crop as a rule as mixing it with any other crop is said to reduce the yield of turmeric. However, castor and vegetables may be seen as a light mixture here and there, intended mainly for houeshold purposes.

Cultivation: (1) *General*: Methods of cultivation are more and less the same in Guntur and Krishna districts. The furnace, the curing appliances and method of curing in Guntur District especially in Duggirala area, are somewhat modernized. Cultivation in Cuddapah is slighty different especially in respect of after-cultivation, harvest and curing. In Guntur and Krishna the spacing is 18 inches and inter-spaces are ploughed after the crop is on. The crop is harvested with the aid of the country plough. Curing is done in a water-bath, holding 4 cubical troughs filled with rhizomes. The troughs have perforations on the sides, so that when removed from the bath, the water is drained into the water bath. At Cuddapah the spacing is 12 inches between the rows and it does not permit of interploughing and so hand-weeding is resorted to. The crop is lifted with pick-axes. The furnace is too big, consuming large quantities of fuel and the pan is similar to a jaggery boiling pan. The curing methods of Guntur might possibly be introduced in Cuddapah. The average yields, and the quality of the produce are almost the same in all these districts ranging from 10 to 12 candies per acre. The yields appear to be the highest in the Kodur area. The area under turmeric in individual holdings no doubt varies widely, but on an average it is half to one acre per holding. In a few villages in Tenali and Gannavaram taluks, some ryots cultivate from 10 to 20 acres, at the same time maintaining the normal intensity of cultivation.

(2) *Preparatory Cultivation*: Preparation of the land varies widely from tract to tract, the minimum being two ploughings in Mydukur area of Cuddapah district to 16 ploughings in Rajampet arer of the same district. In Guntur and Krishna 4 to 10 ploughings are given, the average being seven. The land is ploughed with the country-plough, commencing from the harvest of the previous crop or from the commencement of early rains. In the former case the period of preparation extends over 5 to 6 months and in the latter over 1½ to 2 months.

(3) *Manuring*: The crop is very heavily manured and all available manurial resources are tapped to the full.

(i) *Green Manuring*: Green manuring is believed to be advantageous for the crop but is not followed regularly, due to limitations in raising green manure crops during the fallow period. In Reppalli taluk of Guntur district green gram is sometimes raised and ploughed in as green manure with good results.

(ii) *Application of clay and silt*: Carting top soil from wet lands is largely followed in Guntur and Krishna districts. 30 to 100 cart loads per acre are applied. In Cuddapah district silt from tanks and canals is carted wherever possible.

(iii) *Cattle penning*: Cattle penning is a regular practice throughout Guntur and Krishna. This is done during summer from March till June using their own cattle. It works out to 800 to 1000 per acre. This practice is unknown in Cuddapah district.

(iv) *Cattle manure*: Cattle manure is invariably applied in all the places and heavy doses ranging from 20 to 50 carts (each cart-weighting about half a ton) are given. The cost of a cartload of cattle manure is Rs. 3/- to 4/- in the Circars and Rs. 5/- to 6/- in the Cuddapah district.

(v) *Sheep-penning*: Sheep-penning is also extensively adopted in all these districts. 2,000 to 4,000 sheep are penned per acre, costing about Rs 12—8—0 per 1,000 sheep.

The following would represent in general, the quantity of manure an acre would receive.

		Guntur & Krishna	*Cuddapah*
1.	Clay or silt	30 cart loads	50 cartloads
2.	Cattle-penning	800 head loads	...
3.	Sheep-penning	2,000 per acre	3,000 per acre
4.	Cattle-manure	50 cartloads	50 cart loads.

(b) *Top dressing*: Generally groundnut cake is used as a top dressing, at an average rate of 8 bags per acre in two equal doses in September and October with an interval of 1 to 1½ months in between. The cake is powdered and applied along the lines near the base of the plants. Broadcasting the cake over the field and applying it to individual plants are also done, but line application is more common. In Guntur and Krishna the top dressing is followed by ploughing the interspaces for incorporation of the manure. In Cuddapah it is done by hand-weeding and hoeing. In this district leaf-mulching is a common practice. Due to the nearness of forests, leaf is available in plenty, free of cost. Soon after planting, about 20 cartloads of leaf are evenly spread over the surface of an acre. By the time the germination is completed (in about 40 days), the

leaves decay and are littered over the surface. The twigs are then easily shaken and removed. The leaf would gradually gets mixed up with the soil during the weeding operations. This practice is followed in Kodur, Rajampet and Prodatur tracts.

(4) *Planting*: Planting season commences from first week of June and continues up to first week of August. Early planting commencing from June (*Mrigasira*) is favoured in Cuddapah. In Guntur, the main season is July (*Arudra and Punarvasu*) and in Krishna, it is in early August (*Aslesha*).

Mother rhizomes which are round are used throughout Guntur and Krishna districts as seed material. They are cut into two pieces longitudinally each having one round bud. Fingers are used in Cuddapah without cutting, the long pieces being merely broken into two before planting.

The seed rhizomes are dibbled behind the country plough and covered by the next furrow slice. In Guntur and Krishna the spacing is 18″ between rows and 9″ between plants in the rows. In Cuddapah the spacing is 12″ and 6″ respectively. The depth of sowing is about 3″. The seed rate ranges from 4 candies in Guntur and Krishna to 5 candies in Cuddapah. In Cuddapah tract the land is levelled with a levelling board after planting and laid out in beds and channels with a country plough. The size of beds is about 10 x 6 feet. The seed material which comes up during the layout is pressed into the soil during the time of rectification of beds and channels. In Guntur and Krishna, ridges and furrows are formed with the country plough at planting time and rectified later by interploughing during the period of crop growth.

(5) *After cultivation*: Four and weedings are given commencing from a month after planting at intervals of 1 to 1½ months. Total labour required for this operation is about 100 women per acre. The interspaces are also ploughed four times in Krishna and Guntur districts.

(6) *Irrigation*: Major area is under flow irrigation chiefly from canals and to some extent from tanks. In some places where the level of the land is high, swing baskets are used for lifting water, from irrigation channels. Throughout the Kodur area, water is lifted from wells by double mhotes. In parts of Guntur, Bezawada and Gannavaram taluks, lift irrigation by mhotes is common. In some villages of Bezwada taluk electric motors are used for lifting water. Irrigation are given as and when necessary. The total number of irrigations varies with the retentivity of the soils. The total number of irrigations given to the crop is 12 in Guntur and Krishna districts, 16 in Kodur and 20 in Rajampet, Cuddapah and Prodatur tracts. When water is taken from canals or tanks, water rate is charged as for double cropped paddy lands.

(7) *Harvest*: March to April is the main harvest season. Drying of the leaves and stem is the sign of maturity. Dried stems and leaves are picked and reserved for use as fuel. A country plough is worked carefully just by the side of the rows. The rhizomes are neatly lifted and thrown to a side without injury. Women coolies pick the rhizomes. One pair can lift rhizomes from an acre in a day, 50 women can pick and gather the rhizomes, and 10 women can separate the rounds and fingers. This is the practice in Krishna and Guntur. In Cuddapah, lifting is done using a tool called "*Karu*" or "*Pasupu Karu*" resembling a pick axe. 15 men are required per acre for digging the outcrop with this tool. Fresh rhizomes from one plant weight from one to three lbs., the maximum weight being about 6 lbs. The average number of fingers produced per plant is about 10, the maximum being about 40.

(8) *Curing*: Curing is taken up soon after harvest, normally within 4 or 5 days. The rhizomes are boiled in water till frothing takes place and white fumes appear, emitting a characteristic odour when the rhizomes are removed and dried. The stage at which the rhizomes are removed influences the colour and fragrance of the produce. Experienced curers are therefore engaged for this purpose. The furnace resembles the Sindewahi furnace except for the square sides and the absence of the baffle wall and the chimney. The boiling appliances consist of an iron boiling pan 5′ x 5′ x 2½′ to take in four cubical immersion buckets or troughs of iron with perforated sides. A lid is put on, at the time of commencing the boiling.

Boiling: The furnace is lighted and fuel is fed uniformly. After an hour's boiling, frothing commences, and in a few minutes white fumes appear to be pushing out the lid. At this stage the lid is removed. The characteristic smell of cured turmeric develops in a short time and then the boiling is stopped. The troughs holding the turmeric are removed from the pan, while the boiling water flows back into the pan through the holes on the sides of the troughs. The boiled rhizomes are spread on a clean floor for drying. The troughs are again kept inside the boiling pan or tank and charged with another batch of fresh rhizomes. When fresh produce is put in, the temperature is slightly lowered. The water in the tank lost by evaporation is made up and boiling is continued. Each trough takes one bag of 168 pounds of rhizomes and each pan holds 4 troughs at a time. Each boiling takes one hour on an average. The produce from one acre can be cured in 20 boilings and it takes one day if non-stop curing is taken up, as is usually done. Eight men are required for attending to this work. Rounds and fingers are cured separately, as the former takes a longer time for curing.

Fuel: Dried turmeric leaves, redgram stalks, sugarcane trash, tobacco stems country date-palm leaves, babul twigs, and cheap forest wood are all used, depending upon the availability in the respective

localities. In the Duggirala area, the turmeric leaves are carefully conserved for boiling the rhizomes and this is supplemented with red-gram stalks. In other parts of Guntur district, babul twigs are purchased. In Krishna district, sugarcane trash and tobacco stems are used. In Prodattur area, country date-palm leaves are largely used. In other places of Cuddapah district, forest fuel is bought and used. Taking the whole area into consideration, the cost of fuel works out to Rs. 3/- per candy of cured produce. In Cuddapah district dried turmeric leaves are not used as fuel.

The cost of appliances and the labour charges for curing are as below :—

(a)	Construction of furnace, 2 men each at Rs.	1—4—0 per day.
(b)	Cost of iron rods and grating for the furnace Rs.	30—0—0
(c)	Cost of a set of one tank and four buckets at controlled prices. ...	225—0—0
(d)	Cost of pan or tank in local markets ...	240—0—0 each.
(e)	Cost of troughs in the local markets ...	20—0—0 each.
(f)	Hire charges for tank and troughs (full set) ...	1—0—0 per cdy.
(g)	Wages for the curers. ...	1—8—0 per cdy.

Other methods of curing: Previous to the introduction of the water-bath system of boiling described above, the produce was directly heated in iron pots or in pans. The same practice is still in vogue in a few remote villages of Krishna district where iron pots with a capacity of about 150 lbs. of fresh rhizomes are used. In Cuddapah district, the furnaces are much bigger and crude in form, resulting in waste of fuel and the produce is boiled in iron pans which are similar to jaggery boiling pans.

Drying and cleaning: The cured produce is dried on clean drying floors in a thin layer for 10 to 15 days till perfectly dry. Rounds and fingers are separately dried. The rounds take a longer time for drying. The rounds have some adhering roots, which drop off ordinarily during the curing and drying process. Whatever remains is removed by manual labour in some places. In Duggirala tract they are spread in a thin layer and over this straw is spread lightly and burnt. The rounds are kept carefully stirred so that only the roots get burnt. In Prodattur area the plank is drawn over a layer of rounds for the removal of roots and for smoothening the surface. The next process is cleaning. The rhizomes are well rubbed with old gunny pieces or with hand, taking a small basketful each time. This removes the adhering scales and roots and smoothens the surface. The produce is then cleaned by winnowing. This process of rubbing is not done now in Guntur area as machine polishing is done by the exporting firms, and polishing by hand is too expensive.

Yield: The average yield per acre is 10 candies (of 500 lbs. each) of cured produce. When there are pests and diseases, it may be 6 to 8 candies only. Maximum yields go upto 16 to 18 candies per acre. The proportion of cured produce to fresh produce is 1 to 4; i. e. about 40 candies of raw produce gives 10 candies of cured stuff. The proportion of rounds and fingers is also 1 to 4. Normally, 10 candies of rounds are obtained from one acre. On storage till the planting season there is a driage loss of about 5% and about 5 candies of rounds will be available for planting one acre.

(10) *Storage of seed material*: From the time of harvest in March — April, till the time of planting in July, the seed material is carefully preserved. The period of storage is 3 to 4 months. In Guntur and Krishna districts the material is invariably stored under the shade of trees. The seed material is loosely heaped and covered over with a thin layer of dry turmeric leaves. The heap is left undisturbed till required. In parts of Krishna the heap is removed after 1½ months, spoiled rhizomes, if any, are removed and reheaped. In the absence of shade nearby, a number of ryots store the material together in a garden engaging watch jointly, paying a nominal rent for the site. Throughout Cuddapah district the seed material is covered over with ragi straw or neem leaves; but not with dry turmeric leaves. A layer of sands is spread on the floor before heaping. The heaps are also plastered over with earth or dung or a mixture of both. The heaps are not disturbed. If there are no rains in summer, water is sprinkled over the heaps once. Where there is no sufficient shade, low pandals are erected over the heaps. There is also a practice of storing seed material in sheds if space is available. The rhizomes are heaped in a corner over a layer of sand and left uncovered.

11. *Storage of produce:* When the cured produce is not immediately disposed off it is stored in pits dug in an elevated site and allowed to dry for a day or two. The bottom and sides are lined with thick twists of "Rellu" grass *(Saccharum spontaneum).* Over this layer of grass, country date mats are spread at the bottom and the pit is filled with the produce. At the top again mats are spread and over this "Rellu" is spread in a thick layer and finally covered over with earth.

In Guntur and Krishna, the normal size of the pit is 15'x 10'x 7' which holds about 200 bags. Charges for digging the pit and storing the produce are one anna per bag. Cost of grass for one pit is Rs. 49/- at 700 bundles costing Rs. 7/- per 100 bundles. Cost of 20 mats at 0—8—0 each is Rs. 10/-. For the site, rent is charged at 1½ annas per bag irrespective of period of storing. Banks advance money on the stored produce at Rs. 25/- a bag in Duggirala, which is a trading centre for turmeric. In

Cuddapah, the bottom of the pit is lined with paddy husk to a thickness of 9 inches and mats are spread over this layer. The side are lined with a type of wild grass available locally. Pits are circular and rhizomes are heaped over the pits also to form a cone. This type of storage is generally adopted in factory premises. Rent is charged for the site at Rs. 12/- per year for a pit with capacity of about 17 candies having the dimensions 12 feet diameter and 7 feet depth.

12. *Marketing:* Duggivala, Kodur and Cuddapah are important marketing centres for turmeric. The dealers send round commission agents to villages and purchase the produce. Generally the purchase is made at the ryot's door. At Duggirala, there is also the practice of the ryots bringing the produce to the merchants for sale. The agents get Re. 1/- commission per candy from the merchant. All the produce of Guntur and Krishna districts is pooled at Duggirala, and all the produce of Cuddapah and the adjoining districts at Kodur and Cuddapah, wherefrom they are exported.

(i) *Polishing:* Before exporting, the produce is polished in power polishers in all the three centres. A polisher consists mainly of an octogonal wooden drum 4½ feet long and 3 feet in diameter. The sides are made of thick iron sheets and the body is fitted lengthwise with wooden pieces 3 inches wide and 2 inches in thickness. In Cuddapah, 6″ wide planks are used. Babul wood or high class teakwood is used, the former being preferred. Generally a set of four polishers are maintained with an oil engine of about 25 to 30 B. H. P. The polisher is hollow inside. Through the centre a 2″ thick iron rod is fitted for supporting the drum on strong masonary blocks on either side. A pulley is also fitted to the same iron rod or axle for rotating the polisher. The barrel is provided with an opening 1½′ x 1′ which can be closed by means of a door. The polisher is charged through this opening. Each charge takes 7 bags of 168 lbs. each. There are bigger barrels taking 11 bags per charge, but they are not so common. After charging, the door is closed and the drums are rotated for about 1½ hours for "full polishing" at 30 to 35 revolutions per minute. About 7 charges are taken per day. After polishing, the rhizomes are smooth, light yellow in colour and fit for marketing. For certain markets, the produce is polished for only three-fourths to one hour and this called "half-polishing". In Cuddapah, half-polishing is largely in vogue and the rhizomes are later coloured to cater to certain markets. Normally, the factories work for about 8 months in a year. They charge Rs. 2/- to 2—8—0 per candy for full polishing and Rs. 1—8—0 to Rs. 2—0—0 for half-polishing. Certain factories confine themselves to polishing work, while certian others take up trading of rhizomes also. Labour is paid up fixed rates in these factories for the various items of work. Labourers working at the polishers are paid Rs. 12/- per 100 bags. For grading, women are employed at Rs. 4/-

per 100 bags. for weighment Rs. 6—4—0, for stalking Rs. 1—9—0 and for stitching Rs. 0—12—0 per 100 bags are the usual rates. The wooden planks of the polishers require renewal once in 2 to 3 years at a cost of Rs. 300/-. Some of the factories are leased out by the owners for working to others, in which case Rs. 8000/- are paid to the owner. All repairs above Rs. 200/- have to be borne by the owner.

(ii) *Colouring:* In Cuddapah, colouring is done before exporting to certain places like Calcutta, Rangoon, Singapore and Penang. This is done in two ways, dry colouring and wet colouring. In the dry method a yellow dyestuff (middle chrome) is lightly dusted on a small heap of rhizomes and thoroughly mixed. This method of colouring is for the Calcutta market. In wet colouring, the yellow colour is mixed in water and the coloured water is sprinkled over small heaps of rhizomes and rubbed well. The produce is then well dried for about a week. For both the purposes only half-polished stuff is used. Wet colouring gives a better-looking material, and fetches a better price in the market over the dry-coloured rhizomes. The colour that is used for this purpose is "Middle chrome" manufactured by International Chemical Manufacturing Company, Calcutta. It is sold in half-pound packets costing Rs. 1—8—0 each. A packet is used for treating 2 candies of turmeric. The colouring is done by dealers who use the premises of factory paying a rent of Rs. 2/- per candy for storage.

(iii) *Factories:* The location of turmeric factories and their capacities are given below :—

		Number of Factories	
1.	Duggirala–Guntur District	6	Each with 4 polishers.
2.	Tenali do.	2	do.
3.	Cuddapah	3	Two with 4 and 1 with 3 polishers.
4.	Kodur—Cuddapah District	2	Each with 3 polishers.

(iv) *Trade*: The following is the approximate quantities of produce handled per year in the various trading centres :—

1.	Duggirala	2,50,000	Bags
2.	Kodur	30,000	,,
3.	Cuddapah	30,000	,,

Another 2,00,000 bags per year are powdered and exported to various centres in this Province. The following are the importing centres.

(a) Within the Province :

1. Madras
2. Tiruchirapalli
3. Madura
4. Erode
5. Duggirala

Erode and Duggirala import turmeric from other places and export it after polishing.

(b) Within India.

1. Calcutta
2. Delhi
3. Cawnpore
4. Agra
5. Amritsar
6. Bombay
7. Assam
8. Rangoon
9. Karachi
10. Nagpur
11. Chittagong
12. Lahore

(c) Outside India and Burma :— (Pre-war annual Export 2000 tons roughly).

1. Iraq 2. Iran 3. S. Africa 4. Germany

(v) *Foreign exporters* :—

1. Gordon Woodroffe & Company
2. Volkart Bros.
3. Krishna & Company, Tuticorin
4. B. L. Narayana & Company, Cocanada
5. D. Ananta Rao & Company, Madras
6. Mittalal & Company, Madras

(vi) *Prices :* The prices during May 1948, ranged from Rs. 180/- to 210/- per candy of 500 lbs. The maximum price reached was Rs. 270/- in 1947 and the minimum was Rs. 27 per candy in 1937. The average price over a long period was Rs. 80/- per candy. Normally fingers sell at a higher rate, with a difference of about Rs. 10/- a candy. But, during this year the rounds are selling at a higher rate with a difference of Rs. 20 to 30/- a candy. The prevailing prices at the consuming centres ranges from Rs. 250/- to 300/-. The estimated net average profit realised by traders is about Rs. 20/- per candy.

(vii) *By-Products :* During the process of polishing, the fine yellow dust that gather is collected and used as manure for paddy fields. It is said to give good results. It is sold at Rs. 1/- per bag.

13. *Pest and diseases :* The crop frequently gets the "leaf spot" disease known variously as "Thataku tegulu", "Lambadi tegulu" "Jampu tegulu" and "Yerrapoda" in different localities. "Rhizome rot" occurs now and then and is called "Pippi tegulu" and "Kommu tegulu" where the rhizomes decay and become soft. Rarely, the base of the plants

and the rhizomes are attacked by borers and this is called "Oola telugu" and "Morum". Generally, the incidence of pests and diseases is not high and no serious damage is caused. Bordeaux mixture checks the leafspot disease if the plants are regularly sprayed with it. When the cured produce is stored for a long time in gunnies, it is attacked by borers. The produce is therefore stored in pits, to avoid this.

14. *Cost of Production :* The average costs of production at the current rates are :

1.	Seven ploughings at Rs. 3/- per ploughing	Rs. 21/-
2.	30 carts clay @ Rs. 2/- including carting	60/-
3.	Cost of penning 800 cattle (labour only)	40/-
4.	Penning 2000 sheeps @ 12—8—0 per 1000	25/-
5.	Cost of 50 cart cattle-manure Rs. 3 per cart load	150/-
6.	Cost of carting the @ 0—8—0 per cart	25/-
7.	Cost of 8 bags of groundnut cake @ Rs. 8—8—0 each	68/-
8.	Spreading manure and covering	5/-
9.	Cost of 4½ candies seed material at Rs. 50/- a candy	225/-
10.	Preparation of seed material and planting	8/-
11.	4 Weedings ... 100 women	50/-
12.	4 Ploughings ... 4 pairs	12/-
13.	Water rate and labour for irrigation	15/-
14,	Harvesting, gathering and separating rhizomes	35/-
15.	Curing, drying, and cleaning charges Rs. 5 per candy	50/-
16.	Transport and storage charges	11/-
	Total Rs.	800
	Value of 10 candies of produce @ Rs. 110/- per candy	1100
	Net Profit per acre	910

HINTS TO FARMERS

Hints on the preparation of Artificial Farmyard Manure : (*Compost Manure*) — Application of adequate amounts of bulky organic manure for providing humus to the soil is an absolute necessity for maintaining soil fertility and for increased crop production. As the farmyard manure the chief source of supply of humus to the soil is however greatly inadequate to meet the needs of the existing area under crop, attempts to tap other sources of supply led to the result that any carbonaceous organic material such as agricultural wastes, weeds, leaves, grass, etc., can be easily converted at no great cost into a substance similar in appearance and manurial value to the farmyard manure by comparatively simple methods.

On a consideration of the several methods of composting developed by different workers in India, the following general procedure is recommended for adoption.

Pits 5′ to 6′ broad, 15′ to 20′ long and not more than 3′ deep, may be dug on elevated ground. The organic material, preferably a mixture of several waste substances, is spread on the bottom of the pit to a depth of 6″ to 9″. If the basic material is dry, it may be dipped in water and the water drained, before putting, in the pit. If moist, the stuff may be placed straightaway in the pit. Wood ashes and urine earth are sprinkled over the layer of the organic matter followed by a fairly thick emulsion of cowdung. Another layer of the raw material is piled above to a thickness of 6″ to 9″ and treated with wood ashes, urine earth and cowdung water as described for the first layer. The heap in the pit is thus built up to a foot or two above ground level. The surface layer may be made dome-shaped and treated with cowdung water, wood ashes and urine earth. After four or five days, the top surface is covered with a 3 to 4 inch layer of earth. The earth cover serves to conserve the moisture within the heap, to prevent rain water getting in and to absorb any ammonia that might otherwise escape into the air.

After five to six months and with ordinary materials, not too coarse or woody, the decomposition will be found to be satisfactory. If the manure is required sooner, the heap may be opened at the end of the first month and the contents given a turning with adequate watering and repiled. Two more turnings at the end of the second and third months will complete the decomposition. Frequent turnings and waterings no doubt promote the rate of decomposition but add considerably to the cost of production.

The main considerations that have to be borne in mind in converting farm and other wastes into compost manure by biological means are as follows :—

1. *An adequate supply of available nitrogen*: This condition is more likely to be attainable by putting into the compost heap a mixture of a variety of substances than material of a particular kind. Cowdung and particularly urine earth provide nitrogen as well as the organisms needed for decomposition.

2. *Proper aeration and moisture*: As the formentation is brought about chiefly by aerobic organisms, the heap must be so built as to allow sufficient air maintained at about 50 to 60 per cent of the material.

3. *A neutral reaction*: As the products of decomposition are likely to produce acid conditions in the heap and as a neutral or even a slightly alkaline reaction is considered favourable, sprinkling of wood ashes over every layer of the material is recommended.

The compost manure prepared as above has been found to compare very favourably with farmyard manure in respect of soil improvement and increased crop production. (Villagers' Calendar 1948.)

REVIEW

Food Problem in India in General and in Kolhapur in Particular — By Dr. P. C. Patil: Dr. Patil, a pioneer in the field of agricultural economics, deals with the burning problem of the day which tends to become more and more acute as days go by. India and Pakistan, he estimates, will have in 1971 a population whose food requirements will be double the present. He traces the growth of the problem in recent times and dispels some unfounded notions that there is any extent of culturable land in India, that our land is a *swarnabhumi*, superior in fertility to lands in other countries, that our climate and rainfall are on the whole favourable for crop production — all resulting in the belief that our population is not excessive for the land we have. But we have in fact only 8 acres per capita in India. The situation has indeed grown worse since the partition of the country, which has not been stressed. Information of a familiar kind is furnished on functions of food, on the calories required for sedentary workers and manual workers 2500 and 3500 calories respectively. The deficit in different kinds of food as estimated by Dr. Burns is given though the statistical basis for estimates of vegetables, fruits, milk etc., is flimsy. Dietary conditions of different groups of society are pictured but are not based on any elaborate data collected over a wide area. We are told that the diets of the first two groups are satisfactory. We are not sure whether they are so qualitatively. But we are sure that 65 per cent of the population do not get enough food grains.

Dr. Patil is of the view that the problem of food production can be solved best by the construction of irrigation works — major and minor so far as western India including Kolhapur is concerned — particularly by the construction of Koyna and Daddi projects. The Kolhapur ryot is said to be keen and progressive especially in lifting water by a series of mhotes or oil engines for cultivating sugarcane on a large scale. The ryot at Coimbatore does as well in lifting water from very deep wells and now-a-days is resorting to electric pumping for the cultivation of a variety of garden crops.

He praises the work of the Regency Council in the past in putting up dams across rivulets, in sanctioning loans for digging wells at 2 per cent (but only up to Rs. 6 lakhs) and in the work of reafforestation of Satyayadri hills. But Kolhapur has now ceased to be an independent state, we are sure however, that by its merging in a wider Province with far greater resources it will not suffer — K. C. R.

Gleanings.

Twenty years of cotton Research in Egypt: Looking back over these twenty years, one cannot but feel regret that more was not done with the results obtained. Lack of concentration and sustained attention was due in part to the overweighting of the technical sections with accessory staff, which in turn involved distracting administrative responsibilities for the senior scientific officials, conducted within the limitations of rigid governmental rules and regulations. Promotion for good service was hard to obtain. The scientific worker devoted to his subject was too fully occupied to have the time for acquiring the necessary influence. Publication of results was very uneven and the war made matters hopelss; brevity is usually a sure indication of clear thinking and scientific value, but the tradition of the East put a premiun on prolixity and the emphasis is onwords rather than on work. The acquisition of status and power over fellow officials is too often valued far above scientific reputation and experimental ability and it is yet to be realised that for real progress in science it is essential to have a stiffening frame of professional scientists as distinct from professional officials (W. L. Balls (1948) Emp. Cotton Growing Review 25. [T. R. N.]

New Treatment for Cattle Disease: Glaxo Laboratories, who a year ago pioneered the massive dosage technique in the penicillin treatment of bovine mastitis, have announced an important advance in the treatment of this widespread disease. By combining procaine with penicillin rapid and complete eradication of bovine mastitis, it is claimed, can be achieved, with only two injections within 72 hours, instead of the four or five previously necessary with ordinary penicillin. This is the first time in veterinary medicine that procaine-penicillin has been used in the treatment of bovine mastitis.

The great advantage of the new preparation is that procaine-penicillin, supplemented by a strong water-repellent agent, aluminium stearate, results in an extensive prolongation of penicillin activity in the milk system and associated tissues by reducing the number of treatments per quarter to a minimum. The veterinary surgeon is thus able to give greater personal attention to herd treatment, and the cost per head is less. The preparation, which is non-irritant, leaves the milk free from discoloration. The yield is also unaffected by the process, which ensures only a minor disturbance to the animal.—[B. F. 958]

Scientific Grain Storage New Methods of Combating Infestation: Several successful methods for combating infestation in the storage of grain are mentioned in the first report now issued on pest infestation research in Britain. One of these is the "carbon dioxide" method for estimating the infestation of a given sample of grain. This consists of bottling a sample and incubating it for a short period, generally 24 hours, after which the carbon dioxide content of the air between the grains is measured. The grain itself produces a negligible amount of carbon dioxide in such a time, but the insects produce a measurable quantity. Broadly, the concentration of carbon dioxide found is proportional to the number of insects present inside the grain. It was also demonstrated that insects could and did cause grain to heat through the formation of "hot spots".

The report says that there was a great need for a fumigant as toxic to insects as hydrogen cyanide, which would not be so easily absorbed. Such a fumigant was found in methyl-bromide. The first full scale trials were made on empty bags on barges. Bagged shellnuts were then treated and also groundnuts in shell which were loose in barges. The treatment of bulked materials in barges had always been considered impracticable. Work on warehouse sprays was undertaken in view of the necessity of disinfecting the building in which insect free foodstuffs had to be stored. The main difficulty was ensuring a reasonably long toxic life to the insecticide film deposited on the wall. A method was developed for pre-treating surfaces to be sprayed which gave a greatly increased duration of toxicity. The report covers some years' work by the Pest Infestation Laboratory of the Department of Scientific Research and is published by the British Stationery Office. [B. F. 1483]

New Farm Implements: Two new farm implements, *a potato planter* and *a fertilizer distributor*, both costing well under £ 100 (Rs. 1,333), have been developed in the United Kingdom. Both are automatic and operated by a tractor, the driver needing no other labour. The two-row potato planter comprises a sport-welded steel hopper containing baffles and an inverted V bottom. The drive is by a wavy-edged wheel. By means of sprockets and chains, motion is transmitted to two disc wheels which collect the potatoes into pick-ups on the perimeter, each comprised of two prongs and a lip, and drop them into furrows prepared by two ridging bodies. Potatoes can be planted at a space of 15, 20. 24 and 30 inches at the rate of six to eight acres per day. The fertilizer distributor, claimed to be the first mounted distributor in Britain, has a capacity of 3 or 4 cwt., and sows from 1 to 30 cwt. per acre. An unusual feature is the main drive which is by a chain from a sprocket mounted by three studs on the near-side wheel hub of the tractor. The machine weighs well under 6 cwt. [B. F. 1415]

Vitamins and Social Dominance: A chromic deficiency of vitamin B has a profound influence on social dominance and behaviour. This has been established by experiments on dogs, hens, mice canaries and cattle. Chromic vitamin B, deprivation in dog litters effect the order in which the puppies go to the food pan, the tendency to relabate when bitten by others, and the relative or absolute immunity of any animal in the group from attack by other animals. In one bitter of four male and one female pups, the least dominant animal, a male was severely bitten and so regularly driven away from the feeding pan, that it had to be isolated in a separate cage and given a special diet, which included milk and raw beef. The other animals were placed on a diet of water canned dog food and a type of dry dog chow. After three weeks the isolated animal was again placed in the cage with his lither mates and none the previous social demeniance was reversed. He became the dominant animal of the lither after several fights with each of his lither mates. After a week of this, an increasing loss of appetite followed by symptoms of "fright disease" was noted in those animals which had been fed for several weeks on commercial dog food ration. Commercial dog foods are usually anthclaved and vitamin B, being heat labile is destroyed as a result. 600 I units of vitamin B were injected subcutaneously in all five animals daily for four days. A number of fights ensued between the litter mates and the previous dominant male resumed his acendant position in the social hieracty. The male which had orginally been the lowest and after the special diet highest in the order of dominance ended as the third highest in the social group of litter mates. The solitary female pup was the lowest in the new order of dominance which remained so for two months, after which no further observations were made. Similar dominance shifts associated with vitamin B, deprivations have been noted, though not in such detail, in other lithers as well. (Science 105, March 1947, p. 57. T. R. N.)

Crop and Trade Reports

Statistics — Crop — Groundnut — 1949 — Summer and early crops — Condition Report : Sowings of the Summer crop of groundnut are reported to be below normal in the districts of Chingleput, Chittoor and North Arcot due mainly to the failure of rains. The area sown with Summer Crop in the other districts is reported to be normal. Sowings of the early crops are in progress in the districts of Salem and Coimbatore and the area is reported to be normal in both the districts.

2. The Summer crop of groundnut has been harvested in most of the districts. The yield per acre is expected to be normal in the districts of Cuddapah, Tiruchirapalli, Tanjore and Mathurai and below the normal in the other districts due mainly to inadequate supply of water from irrigation sources.

3. The wholesale price of groundnut (shelled) per Imperial Maund of 82 2/7 lbs. (equivalent) to 3,200 tolas as reported from important market centres on 2nd July 1949 was Rs. 29—1—0 in Adoni, Rs. 29—0—0 in Coimbatore, Rs. 28—6—0 in Guntur, Rs. 27—14—0 in Cuddalore and Salem, Rs. 27—9—0 in Tadpatri, Rs. 27—7—0 in Nandyal, Rs. 26—6—0 in Hindupur, Rs. 26—2—0 in Vizianagaram, Rs. 25—9—0 in Bellary, Rs. 25—7—0 in Vellore, Rs. 25—4—0 in Erode and Rs. 23—8—0 in Cuddapah. When compared with the prices published in the last report i.e those which prevailed on 9—4—1949, these prices reveal an increase of 2 per cent in Adoni, 9 per cent in Guntur, 8 per cent in Tadpatri, 7 per cent in Salem, 6 per cent in Cuddallore, 4 per cent in Nandyal and Erode, 2 per cent in Coimbatore and 0·2 per cent in Hindupur, the price remaining stationary in Cuddapah. (Public Economics and Statistics Dept.)

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 8th July 1949 amounted to 2,18,837 bales of 392 lb. lint as against an estimate of 3,01,800 bales of the total crop of 1948—49. The receipts in the corresponding period of the previous year were 2,55,711 bales.

2,86,714 bales mainly of pressed cotton were received at spinning mills and 2,835 bales were exported by sea while 61,828 bales were imported by sea mainly from Karachi, Bombay and Egypt.

Agricultural College and Research Institute Library, Lawley Road P. O., Coimbatore

MONTHLY LIST OF ADDITIONS FOR JUNE 1949

1. BENNET (H.): Practical Emulsions. Edition 2. 1947
2. CAMP (H. W.) etc., International Rules of Botanical Nomenclature. 1948
3. COLIN (Edward C.): Elements of Genetics, Mendel's Laws of Heredity with Special Application to Man. Edition 2. 1947
4. SAVES (Y. R.) and MAZUYER (G): Natural Perfume Materials — A Study of Concretes, Rosinoids, Floral Oils and Pomades. 1947
5. PARRY (J. N.): Spice Hand-work, Spices, Aromatic Seeds and Herbs. 1945
6. REYNOLDS (P. A.): Farm Mechanisation, Hand-book and Manual. 1948

Weather Review — For June 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches	Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	2·0	—3·5	2·8	South.	Negapatam	1·0	—0·2	5·7
	Calingapatam	2·9	—1·8	4·5		Adutturai*	2·6	+1·8	6·0
	Vizagapatam	3·1	—1·0	9·6		Pattukottai*	0·6	—0·5	3·5
	Anakapalle*	2·1	—1·2	8·5		Mathurai	1·2	—0·4	12·7
	Samalkot*	2·7	—1·9	5·7		Pamban	Nil	—0·2	8·3
	Kakinada	6·6	+1·9	10·1		Koilpatti*	1·5	+1·1	8·1
	Maruteru*	4·6	+0·8	8·7		Palamcottah	Nil	—0·4	9·9
	Masulipatam	3·1	—1·1	6·3		Amba-samudram*	0·4	—1·0	5·8
	Guntur*	5·0	+1·1	10·1					
	Agrl. College, Bapatla	3·2	+1·2	6·0	West Coast.				
	Veeravanam (College Farm)	3·5	(x)	5·3		Trivandrum	10·9	—2·3	26·3
						Cochin	22·9	—5·6	48.8
						Calicut	25·3	—9·5	57·8
						Pattambi	21·9	—5·2	41·7
Ceded Dists.	Kurnool	4·5	+1·6	8·6		Taliparamba*	31·7	—13·5	52·1
	Nandyal*	6·0	+2·9	8·8		Nileshwar*	44·8	+2·9	71·4
	Hagari*	1·4	—0·3	4·6		Pilicode*	38·2	—5·4$	59·1
	Siruguppa*	3·1	—0·7§	5·6		Mangalore	45·0	+4·8	68·1
	Bellary	1·7	Norml	4·1		Kankanady*	43·7	+5·0	66·6
	Rentichintala	7·6	+4·0	11·1					
	Cuddapah	4·5	+1·5	7·0	Mysore & Coorg.				
	Anantharajpet*	4·9	+2·3	8·4		Chitaldrug	2·1	—0·5	5·3
						Bangalore	3·7	+0·8	7·4
Carnatic.	Nellore	1·7	+0·4	11·2		Mysore	1·6	—0·9	9·2
	Buchireddi-palem*	2·1	+0·7	7·5					
	Madras	4·0	+2·1	12·9	Hills.	Mercara	17·4	—8·1	32·3
	Tirurkuppam*	7·5	+5·3$	14.0		Kodaikanal	4·1	—0·1	13·4
	Palur*	6·3	+5·4	10·8		Coonoor*	1·6	—2·1	10·8
	Tindivanam*	4·6	+2·8	6·1		Ootacamund*	5·2	—0·6	16·9
	Cuddalore	4·2	+2·8	8·5		Nanjanad*	2·7	—5·8	10·9
Central.	Vellore	7·9	+5·1	12 1					
	Gudiyatham*	8·4	+6·3	10·7					
	Salem	4·7	+1·6	13·3					
	Coimbatore (A. C. R. I.)*	0·2	—1·4	4·3					
	Coimbatore (C. B. S.)*	0·4	—1·3	4·1					
	Coimbatore	0·2	—1·3	5·2					
	Tiruchirapalli	2·4	+0·6	7·0					

Note :— (1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) x Readings are being recorded only from February 1948.

(4) § Taluk office normal is 3·04", and Rainfall is 2·30".

(5) $ Average of six years data for Tirurkuppam, and seven years data for Pilicode is given as normal.

Weather Review for June 1949.

The South-West Monsoon established itself in South Malabar on the 3rd June 1949 and was active in the South Konkan and Malabar respectively upto 10—6—49 and 13—6—49. In fact, on 14—6—49 the monsoon had temporarily withdrawn from the West Coast of the Peninsula and North-East India. This break in monsoon continued for three days. Three days hence the monsoon again became active in Malabar and the South Konkan, and continued to be so for six days. Once again, a general weakening of the monsoon along the West Coast was noted on 26—6—49; from thence it has not gained any vigour till the end of the month.

Monsoonic showers were received in many parts of Tamilnad, Andhradesa and Rayalseema. Particulars regarding the heavy falls are detailed below:—

Serial Number	Date or dates.	Place.		Rainfall in inches
1.	1—6—49	Calicut	...	3·0
2.	3—6—49	Vellore	...	2 3
3.	,,	Cuddapah	...	2·1
4.	8—6—49	Alleppey	...	2·8
5.	20—6—49	Cochin	...	2·6
6.	24—6—49	Mercara	...	2·7
7.	27—6—49 & 28—6—49	Mangalore	...	4·5

The month began with a fairly severe summer in Kakinada. Places like Ongole, Masulipatam, Rentachintala and Negapatam had the spell of summer weather in the course of the month under review.

Monsoon Forecast for June to September 1949. (Indian Daily Weather Report dated 9—6—49: matter reproduced as given in the report).

"1. Of the forecasting factors used in forecasting the monsoon rainfall in the Peninsula (consisting of Gujarat, Saurashtra and Cutch, the Konkan, the Bombay, Deccan, the Central Provinces, Hyderabad and Northern Madras Presidency), the South Rhodesian rain and the Java rain are very favourable. The South American pressure is indifferent but the Dutch harbour temperature is moderately unfavourable. Taken as a whole, there is a four to one chance that the total monsoon rainfall in the Peninsula during the month June to September will be above 98% of the normal.

2. Of the factors used to forecast the total monsoon rainfall in North-west India (taken to consist of the West United Provinces, the East Punjab, Kashmir and Rajputana), the South Rhodesian rain is very favourable. The equatorial pressure is favourable, the South American pressure and Dutch harbour temperature and the Himalayan snow accumulation are slightly unfavourable. Taking all the factors together, there is a four to one chance that the total monsoon rainfall of June to September 1949 in North-West India will be above 92% of the normal.

3. There is a four to one chance that the total monsoon rainfall in North-east India during the months—June to September 1949 will be between 90% and 110% of the normal.

4. **Summary of the Monsoon Forecast:** There is a four to one chance tha the total monsoon rainfall during the months – June to September 1949 in the Peninsula and North-west India will be either normal or slightly above normal and in North-East India very nearly normal".

M. B. V. N. & C. B. M.

Departmental Notifications

GAZETTED SERVICE—POSTING AND TRANSFERS

Name of Officers	From	To
Janab Ansari Baig	D. A. O., Cuddapah,	Deputed to Sholapur for Training in Soil Conservation.
Sri Venkateswara Iyer, P. A.	Superintendent C. F.,	Special Lecturer in Agriculture, Agricultural College, Bapatla.
,, Krishna Reddy, T.	On leave,	Special D. A. O., Arakev, Vizagapatam District.
,, Ramakrishna Rao, K. L.	D. A. O., Nellore.	D. A. O., Tanjore.
,, Satyanarayanamoorthy, M.	D. A. O., Ooty.	D. A. O., Cuddapah.
,, Subbiah Mudaliar, V. T.	S. L. A., Agricultural College, Bapatla,	L. A., Agricultural College Coimbatore.

APPOINTMENTS

Satyanarayanamoorthy, K.	Assistant in Plant Physiology Agricultural College, Bapatla.
Miss. Sarasvathi, P.	Demonstrater, Cocanada, (Fruit and Fruit Products Development).
Srimathi Sabharan Jammes	Assistant in Paddy A. R. S., Maruteru.
Sri Balasubramanian, C. R.	Cotton Assistant for Winter Scheme, Coimbatore.
,, Ayyamperumal, S.	Cotton Assistant—Tinnies' Scheme, Koilpatti.
,, Appadurai, R.	Millet Assistant, M. B. S., Coimbatore.
,, Balasubramanian, A.	A. D., Rasipuram.
,, Balraj Joseph, J.	A. D., Tiruvannamalai.
,, Chacko, C. J.	Assistant in Fruits—Coonoor.
,, Chandrasekaran, H.	A. D., Gudiyatham.
,, Ebenezer, J.	A. D., Plant Protection Scheme, Tanjore.
,, Gopalakrishnan, V.	A. D., Arni.
,, Gopalan, N.	Assistant in Oil Seeds A. R. S., Tindivanam.
,, Jayaraj, M. V.	Cotton Assistant for Winter Scheme, Coimbatore.
,, John Knight,	A. D., Wandiwash.
,, Krishnamoorthy, C.	A. D., Tiruvellore.
,, Mutharasan, G.	Cotton Assistant A. R. S., Palur.
,, Mathew, K. T.	Assistant in Entomology—Waynad.
,, Muthuswamy, K.	A. D., Nannilam.
Miss. Mukta, M.	Assistant in Mycology, Coimbatore.
Sri Makudeswaran, K.	Assistant in Millets, M. B. S., Coimbatore.
,, Prabuswami, G. R.	A. D., Virdhachalam.
,, Rama Rao, B K.	A. D., Karkal.
,, Ramakrishna Nambiar, C.	Assistant in Oil Seeds A. R. S., Tindivanam.
,, Ramachandran, K.	Assistant in Cotton—Tinnies' Scheme, Koilpatti.
,, Ramakrishnan, G.	A. D., Kulitalai.
,, Ramadoss, R.	A. D., Tiruvarur.

Sri Shanmugam, S.	A. D., Pudukottai.
,, Sankarankutty, M. M.	F. M , A. R. S., Pattambi.
,, Stephan Mathias,	Assistant in Paddy, Mangalore.
,, Sethuraman, V.	Cotton Assistant, Palur.
,, Srinivasan, K.	Cotton Assistant, Winter Scheme, Coimbatore.
,, Sankarayya, M.	A. D., Dindugul.
,, Solyappan, B.	A. D , Vellore.
,, Viswanathan, M. A.	Cotton Assistant Winter Scheme, Coimbatore
,, Vinayakam, S.	A. D., Chengam.
,, Venkatasami, S.	A. D , Harur.
,, Vedachalam, C. D.	A. D., Aruppukottai

POSTING AND TRANSFERS

Name of Officers	From	To
Sri Hanumantha Rao,	Assistant in Plant Physiology Agricultural College, Bapatla,	Farm Manager, Bapatla.
,, Rajanna, B.	A. D., Nannilam	A D. Rayadrug.
,, Narasimha Rao, T. H.	A. D , Wandewash,	Cotton Assistant, Hagari.
,, Ramamohana Rao, S.	A. D , Chengam.	A. D., Anantapur.
,, Ragavendra Rao,	A. D., Gudiyatham,	A. D., Gooty.
,, Narayana Rao, K.	A. D. Gooty	Journal Assistant Kannada D. A's Office, Madras.
,, Hanumantha Rao,	A. D., Harur,	A. D., Punganur.
,, Vasudeva Rao,	A. D., Vellore,	A. D., Bimilipatam.
,, Venkiah, P.	A. D., Tiruvannamalai,	Sp. A. D., Sugarcane Development, Hindupur.
,, Parthasarathy, T. K.	Engineering Supervisor Coimbatore,	Deputed to Sholapur for training in Soil conservation.
,, Gopalakrishnan, R.	Assistant in Paddy A. R. S., Pattambi,	Journal Assistant for Malayalam D. A's office, Madras.
,, Narayana Reddy, B.	Spl. A. D., Sugarcane	Deputed to Sholapur for training in soil conservation
,, Nageswara Rao, S.	A. D. Pollachi,	F. M. Hagari
,, Seethapathi Rao, C.	F. M. Hagari	Deputed to sholapur for training in soil conservation
,, Sitaramaswamy, U. B.	F. M., Araken,	F. M., Government Dairy, Vizagapatam.
,, Narasimha Sastry, M. V.	F. M., Government Dairy, Vizagapatam,	F. M., Agricultural College, Bapatla.
,, Naidu, S. V.	F. M., Bapatla,	A. D., Markapur.
,, Thomas, M.	F. M., Nileshwar II,	F. M., Wynad, Colonisation Scheme.
,, Venkataratnam, G.	On leave,	A. D., Chicacole.
,, Ramakrishna Raja, K.	A. D., Chicacole,	F. M., Samalkot.
,, Subramania Iyer, K. K.	A. D., Tindivanam,	A. D., Tanjore.

Name of officers	From	To
Sri Shanmuga Nainar, T. P.	A. D., Tanjore,	Deputed for Training in Engineering at Coimbatore.
,, Balraj G. J.	On leave,	F. M., Palur.
,, Krishnamoorthy Rao, S.	P. A., to D. A O., Bellary,	Special A. D., Thungabhadra Project.
,, Muthuswamy, P. N.	Sp. A. D., firka development, Tirumangalam,	A. D., Tirumangalam.
,, Sitaramyer, D.	A. D. Tirumangalam	A. D., Kanigiri.
,, Sankara Reddy, G. H.	On leave	Soil conservation Assistant, Bellary.
,, Mohamad Zaimulabdeen	On leave	F. M. Arakuval.
,, Satyanarayana, T.	F. M. Palur	Sp. A. D., Tobacco Works, Sendarampatti.
,, Jagannathan, A.	Kannimetta, A D., Chicacole.	A. D., Gummalakshmipuram.
,, Hanumantha Rao, M.	F. M., Palur,	Narasaraopet.
,, Rama Rao, M.	F. M. Palur,	White Northern's Scheme, Nandyal.
,, Olulapathy Choudry	Narasaraopet,	Do.

RETIREMENT

SRI R. N. K. SUNDARAM, C. D. A., N. D. D. In the retirement this month of Sri R. N. K. Sundaram, Senior Lecturer in Agriculture, Agricultural College, Coimbatore, the Madras Agricultural Department loses one of its able and experienced officers and the Madras Agricultural Students' Union, one of its sincere well-wishers. Sri Sundaram had his early education at the St. Gabriel's High School, Madras and in 1915 left for the United Kingdom, where he continued his studies in Scotland, in the Agricultural College affiliated to the Glasgow University. In 1919 he qualified for the C. D. A. and N. D. D., the brightest qualifications obtainable in Dairying in England and Scotland at the time. After completion of his studies, he was employed as assistant in Botany in Glasgow Agricultural College, a post which he resigned shortly to return to India. He was appointed in 1921 as Assistant Director of Agriculture in the Madras Agricultural Service and those early days of the Department was responsible for a great deal of pioneer work in the organisation of Co-operative seed form societies for the production of Co. 2 cotton seed in the Coimbatore and Salem district. Later as Assistant Director in the Circars Area, he was able to organise an effective large scale propaganda for cultural and manurial trials on paddy and sugarcane. He was responsible for popularising the green manure legume pillepesara; in Rajamundry from where it has now covered practically the whole of East and West Godavari districts. In fact it may be said without exaggeration, that in the course of the 28 years of service in the Agricultural Department, he has been able to do something good in practically every district of our Presidency. He combines, to a degree that is all too rare in those days of narrow specialisation, a wide range of knowledge and interests, together with a wise and tolerant outlook on all controversial issues and was for a number of years — a very helpfull member of the Madras Agricultural Students' Union. We wish him many long and happy years of retired life.